

REMARKS

Claims 27, 28, 37, and 38 stand rejected under 35 USC 112, second paragraph.

Claims 20 and 21 stand rejected under 35 USC 103 as being unpatentable over Kelly (5683600) in view of Neil (6809291) and Kobayashi (20040173942) or Chang (6864459). Claims 22-26, 28-36, 38, and 39 stand rejected under 35 USC 103 as being unpatentable over Kelly (5683600) in view of Neil (6809291) and Kobayashi (20040173942) or Chang (6864459), and further in view of Mead (6541731). Claims 27 and 37 stand rejected under 35 USC 103 as being unpatentable over Kelly (5683600) in view of Neil (6809291) and Kobayashi (20040173942) or Chang (6864459), in view of Mead (6541731), and further in view of Mega (20040169022).

*Applicant's Response to 35 USC 112 Rejections*

Applicant has amended the claims to provide proper antecedent basis. Applicant respectfully requests the 35 USC 112 rejections be withdrawn.

*Applicant's Response to 35 USC 103 Rejections of Claims 20 and 21*

Modifying Kelly with Knowledge Evidenced by Neil, Kobayashi, or Chang is Impermissible

Examiner proposes to modify Kelly with other references to form the basis of a 35 USC 103 rejection. Applicant notes that Kelly states "It is another object of the present invention to provide a method that permits drilling a shaped or compound cooling hole in a **single** laser drilling operation." (Background). Kelly also states "Thus, the compound hole 14, with a trapezoidal shaped diffuser opening 26 and a circular or cylindrically shaped upstream channel portion 24, can be formed completely by laser drilling in a **single** laser drilling operation without the need for an EDM operation." (Column 6, lines 6-10).

The Neil, Kobayashi, and Chang references teach multi-step operations. Neil: "The micromachining method and apparatus creates an **initial** ultrashort laser pulse to ignite the ablation **followed by** a longer laser pulse to sustain and enlarge on the ablation effect launched in the initial pulse. The **pulse pairs are repeated** at a high pulse repetition frequency and as often as desired to produce the desired micromachining effect." (Abstract). Kobayashi: "The method includes the step of irradiating the conductor layer with a **first** laser beam to form a hole at a processing point in the conductor layer, **and the step** of irradiating the hole with a **second** laser

beam to process the insulating layer, layered on the conductor layer.” (Abstract). Chang: “A laser system produces a **first** laser beam for rapidly removing the bulk of material in an area to form a ragged hole. The laser system produces a **second** laser beam for accurately cleaning up the ragged hole so that the final hole has dimensions of high precision.” (Abstract).

Kelly specifically teaches a single step system, and the other references teach multi step systems, and thus Kelley teaches away from being modified by Neil, Kobayashi, and Chang. As a result, per MPEP 2145.10(D), modifying Kelly by the proposed references is impermissible. Applicant respectfully requests that because all of the 35 USC 103 rejections are based on a modification of Kelly by Neil, and Kobayashi or Chang, all the 35 USC 103 rejections be withdrawn.

### Kelly

Applicant has opted to amend the claims to clarify the nature of the invention. In amended claim 20 Applicant now claims: “using **only** a shorter laser pulse length to produce at least a portion of the sloped walls; and using **only** a longer laser pulse length to produce any remaining portion of the first region and to produce the second region.” As Examiner has noted, “Kelly does not teach using a shorter laser pulse length and a longer laser pulse length.”

### Neil

Neil teaches a short pulse and simultaneous to or shortly after the short pulse, a long pulse, known as “pulse pairs” to machine the piece. (Abstract). These pulse pairs “are repeated as often as desired to produce the desired micromachining effect.” (Abstract). Throughout the entire machined area both short and long pulses are used. Thus, Neil does not teach or suggest Applicant’s claim 20 limitations as asserted.

### Kobayashi

Applicant asserts that Kobayashi is non-analogous art because the material being drilled in Kobayashi is a printed circuit board, which is completely unlike a superalloy gas turbine engine component Applicant claims, and thus would not have commended itself to the Applicant’s attention. Per MPEP 2141.01(a), the art reference must be analogous, and thus Kobayashi cannot serve as a basis for a 35 USC 103 rejection. Further, Examiner asserts that

Kobayashi teaches “it is known to provide a laser for producing a hole with a short laser pulse in a first region of the hole which is the top or outer region of the hole with a longer later pulse for producing a second region of the hole which is the inner region of the hole.” (Instant Office Communication, page 3, first full paragraph). However, Kobayashi teaches this technique in order to produce a **uniform** hole wall: “a through-hole is prevented **from being swollen** in the middle”; “variation of a hole diameter can be **reduced**”; “copper foil and a glass cloth can be prevented from protruding **into** a through-hole”. (Advantages of the Invention). Thus, Kobayashi varies the laser pulses to accommodate the varying characteristics of the material being drilled in order to produce a uniform wall hole. Applicant is unconcerned with a uniform wall, and in fact expects an inhomogeneous wall; “The properties of the cut surfaces are less critical in the interior of the hole, and consequently longer laser pulse lengths, which can cause inhomogeneous cut surfaces, can be used here.” (Paragraph 10). The Kobayashi reference is again not analogous because the reference would not commend itself to the Applicant’s attention because its goals are entirely different that Applicant’s goals.

If Kobayashi is still considered analogous art, Applicant notes that Kelly teaches forming a hole with a non uniform cross section because such a non uniform cross section is required for proper operation of the component: “The increasing cross-sectional area of the hole opening functions as a diffuser to reduce the velocity of the cooling airstreams exiting the holes; the lower velocity airstreams are more inclined to cling to the blade surface for improved cooling rather than separate from the blade.” (Kelly, Column 1, lines 29-34). Thus, it is imperative that Kelly be able to produce a hole with this **non uniform** cross section. Modifying Kelly with knowledge evidenced by a reference that teaches a technique with the stated objective of creating a hole with a **uniform** cross section (Kobayashi) is clearly inappropriate. The technique in Kobayashi only works to create a uniform hole, so modifying Kelly with knowledge evidenced by Kobayashi would render Kelly unsatisfactory for its intended use, which is impermissible per MPEP 2143.01(V).

Finally, if the modification to Kelly by knowledge evidenced by Kobayashi is still made, device would not contain Applicant’s claimed hole that “comprises a first region comprising **sloped** walls.” As such, Kobayashi does not teach or suggest the limitation as asserted.

Chang

As Applicant understands, Chang generally discusses using two different types of lasers to create a percussive drilling, and then a trepanning drilling, but does not teach or suggest varying pulse length as Applicant claims. Further, As Applicant understands, it appears that Chang teaches the second, trepanning operation “for accurately cleaning up the ragged hole so that the final hole has dimensions of high precision.” (Column 2, lines 12-14). Thus, Chang teaches that the finished hole wall is entirely created by the second process. In contrast, in claim 20 Applicant claims “using only a **shorter** laser pulse length to produce at least a **portion of the sloped walls**” and “using only a **longer** laser pulse length in a second process step for producing any remaining portion of the first region **and the second region**.” It takes both the shorter and the longer laser pulse length to create the walls in Applicant’s method. Thus, Chang does not teach or suggest this aspect of Applicant’s claim limitation as asserted.

In summary, Applicant respectfully requests the 35 USC 103 rejection of claim 20, and claim 21, which depends from and includes all the limitations of claim 20, based on Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang, be withdrawn.

*Applicant’s Response to 35 USC 103 Rejections of Claims 22-26, 28-36, 38, and 39*  
Claims 22-26, 28-30, and 33

Applicant has amended claim 22 to claim “using only a shorter laser pulse length in a first process step for producing at least a portion of the sloped walls in the component; using only a longer laser pulse length in a second process step for producing any remaining portion of the first region and the second region in the component.” As argued above, Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang does not teach or suggest the limitations claimed in claim 22. Mead does not teach or suggest the limitations that the other references do not teach or suggest. Thus, Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang in further view of Mead does not teach or suggest Applicant’s claim 22. Applicant respectfully requests the 35 USC 103 rejection of claim 22, and claims 23-26, and 28-30, which depend from and include all the limitations of claim 22, based on Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang in further view of Mead, be withdrawn.

Examiner asserts that figure 1, (presumably of Mead), teaches Applicant’s claims 23 and

33. Applicant understands figure 1 as follows: “FIG. 1 is a graph of the output power versus pulse rate for a third harmonic laser in a conventional via drilling system.” (Column 1, lines 54-55). Applicant cannot locate support for Examiner’s assertion, and requests Examiner point Applicant to where this is taught, or that Examiner withdraw the 35 USC 103 rejection of claims 23 and 33.

Claims 31-36, 38, and 39

Applicant has amended claim 31 to claim “using only a shorter laser pulse length for producing at least a portion of the sloped walls of the hole; using a only longer laser pulse length for producing any remaining portion of the first region and a second region of the hole. As argued above, Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang does not teach or suggest the limitations claimed in claim 22. Mead does not teach or suggest the limitations that the other references do not teach or suggest. Thus, Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang in further view of Mead does not teach or suggest Applicant’s claim 31. Applicant respectfully requests the 35 USC 103 rejection of claim 31, and claims 32-36, 38, and 39, which depend from and include all the limitations of claim 31, based on Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang, in further view of Mead, be withdrawn.

*Applicant’s Response to 35 USC 103 Rejections of Claims 27 and 37*

Claims 27 and 37 depend from and include all the limitations of claims 22 and 31 respectively. As argued above, Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang, in further view of Mead, does not teach or suggest all the limitations present in claims 22 and 31. Mega does not teach or suggest the limitations present in claims 22 and 31 that the other references do not teach or suggest. Thus, claims 22 and 31 survive application of Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang, in further view of Mead, in further view of Mega. Consequently, claims 27 and 37 must also survive this reference combination. Applicant respectfully requests the 35 USC 103 rejection of claims 27 and 37, based on Kelly modified by knowledge evidenced by Neil, and Kobayashi or Chang, in further view of Mead, in further view of Mega, be withdrawn.

Serial No. 10/574,724  
Atty. Doc. No. 2003P10483WOUS

Conclusion

The commissioner is hereby authorized to charge any appropriate fees due in connection with this paper, including the fees specified in 37 C.F.R. §§ 1.16(c), 1.17(a)(1) and 1.20(d), or credit any overpayments to Deposit Account No. 19-2179.

Respectfully submitted,

Dated: July 22, 2009

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